IS 832-1 (2011): Textiles – Determination of Twist in Yarns, Part 2: Untwist/Retwist Method for Single Spun Yarns [TXD 1: Physical Methods of Tests]

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भारतीय मानक

वस्त्रादि — धागे में ऐंठन ज्ञात करना

भाग 1 सीधी गणना पद्धति

(दूसरा पुनरीक्षण)

Indian Standard

TEXTILES — DETERMINATION OF TWIST IN YARNS

PART 1 DIRECT COUNTING METHOD

(Second Revision)

ICS 59.080.20

BUREAU OF INDIAN STANDARDS
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December 2011 **Price Group 5**

Physical Methods of Test Sectional Committee, TXD 01

NATIONAL FOREWORD

This Indian Standard (Part 1) (Second Revision) which is identical with ISO 2061 : 1995 'Textiles — Determination of twist in yarns — Direct counting method' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Physical Methods of Test Sectional Committee and approval of the Textile Division Council.

This standard was first published in 1964 and subsequently revised in 1985. This standard has been revised again to align it with the latest ISO 2061 : 1995 by adoption under dual numbering system. The existing standard specifies two methods, that is Direct counting method and Untwist/Retwist method to determine twist in the yarn which corresponds to ISO 2061 and ISO 17202 respectively. Accordingly this standard has also been published in two parts. Other part is as under:

Part 2 Untwist/retwist method for single spun yarns

The conditioning temperature of 20 ± 2°C as specified in International Standards is not suitable for tropical countries like India where the atmospheric temperature is normally much higher than 20°C. It is almost impossible to maintain this temperature specially during summer when the atmospheric temperature rises even up to 50°C. In view of the above, IS 6359 : 1971 'Method for conditioning of textiles' which specifies a temperature of 27 ± 2°C for conditioning of the test specimens for the tropical countries like India shall be referred.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard with the above deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appear to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 139 : 2005 Textiles — Standard atmospheres for conditioning and testing	IS 6359 : 1971 Method for conditioning of textiles	Technically Equivalent

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 2 : 1973	Textiles — Designation of the direction of twist in yarns and related products
ISO/TR 8091 : 1983	Textiles — Twist factor related to the Tex System

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

TEXTILES — DETERMINATION OF TWIST IN YARNS

PART 1 DIRECT COUNTING METHOD

(Second Revision)

1 Scope

1.1 This International Standard specifies a method for the determination of the direction of twist in yarns, the amount of twist, in terms of turns per unit length, and the change in length on untwisting, by the direct counting method.

1.2 This International Standard is applicable to:

a) single yarns (spun or multifilament);

b) folded (plied) yarns;

c) cabled yarns.

Separate procedures are given for each type of yarn. The method is designed primarily for yarns in packages, but with special precautions the procedures can be used for yarns taken from fabrics. It is not suitable for the determination of twist in a monofilament.

NOTE 1 See also ISO 1890:—[1], *Reinforcement yarns — Determination of twist*, which was prepared especially for the needs of glass textile technology, and ISO 7211-4:1984, *Textiles — Woven fabrics — Construction — Methods of analysis — Part 4: Determination of twist in yarn removed from fabric*.

1.3 This International Standard covers the determination of twist in plied and cabled yarns as follows.

— In plied yarns: the final twist of the plied yarns and the original twist of the single yarn before plying.

— In cabled yarns:

a) the final cabling twist of the yarn;

b) the original twist of the plied yarn after plying, but prior to the last stage of processing;

c) the twist of the single yarn before plying.

1.4 If desired, the twist of single and plied yarn components as they lie in the final structure may be determined by the special procedure given in 10.5.7.

1.5 This International Standard is not applicable, except by agreement, to yarns which stretch more than 0,5 % when the tension increases from 0,5 to 1,0 cN per unit linear density of the yarn expressed in tex. Such yarns may be tested under special conditions of tension which are accepted by all parties interested in the test results.

1.6 This International Standard is not suitable for products of open-end spinning and intermingled (interlaced) multifilament yarns.

1.7 This International Standard is not applicable to yarns which are too large to permit their being placed in the clamps of the testing apparatus without crushing or distortion severe enough to affect the test results.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

1) To be published. (Revision of ISO 1890:1986)

Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2:1973, *Textiles — Designation of the direction of twist in yarns and related products.*

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

ISO/TR 8091:1983, *Textiles — Twist factor related to the Tex System.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 twist: Number of turns about the axis of a yarn based on its nominal gauge length before untwisting.

Twist should preferably be expressed as turns per metre (turns/m), but it may be expressed as turns per centimetre (turns/cm).

3.2 gauge length: Distance between two effective clamping points of the test specimen mounted in the testing equipment.

3.3 initial length: Length of a test specimen under a specified pretension at the beginning of a test.

3.4 change in length on untwisting: Increase or decrease in initial length observed when the specimen is untwisted, expressed as the percentage extension, or contraction, based on the specimen initial length.

3.5 moisture equilibrium for testing: That state reached when the rate of increase in mass of a sample or specimen in a specified (test) atmosphere does not exceed that prescribed for the material being tested. (See ISO 139.)

A textile material is in moisture equilibrium with the ambient atmosphere when it does not exchange water with this atmosphere; its mass then remains constant as long as the experiment is carried out in an unchanged atmosphere. For test purposes, moisture equilibrium is reached by absorption, starting from a relatively low moisture content.

3.6 yarn package: Length or lengths of yarn in a form suitable for use, handling, storing or shipping.

Packages may be comprised of unsupported yarn, such as balls, or supported yarn, such as skeins, cakes, bobbins, cops, cones, pirns, spools, tubes or beams.

3.7 twist factor: Measure of the spiralling orientation of the fibres in a spun yarn or of the filaments in a filament yarn.

It is related to the angle which fibres on the surface of the yarn make with the axis of the yarn and is a measure of the hardness of the resulting yarn due to twist.

4 Principle

The twist in a known length of yarn is removed by rotating one end of the specimen with respect to the other until the components of the yarn being tested are parallel. The exact number of turns required to remove the twist is reported in terms of turns per unit length of yarn.

5 Apparatus

5.1 Twist counter, consisting of a pair of clamps, one of which is rotatable in either direction and positively connected to a revolution counter. The position of one or both clamps shall be adjustable to permit testing yarn lengths from 10 mm to 500 mm. There shall be no play in the clamp which might affect the gauge length.

Means shall be provided for applying tension to the specimen and for rapidly determining the specimen length with an accuracy of $\pm$ 0,5 mm or $\pm$ 2 %, whichever is smaller.

NOTE 2 The limit of 2 % is consistent with the highest accuracy required in counting the number of turns in the specimen.

The counting device shall be capable of recording the number of revolutions of the rotatable clamp.

If the contraction or extension of the untwisted specimen is to be measured, the movable but nonrotatable clamp shall be capable of travelling with essentially no friction.

5.2 Dissecting needle.

5.3 Means for magnifying the specimen being tested.

5.4 Equipment for reeling laboratory sample skeins (optional).

6 Standard atmosphere

The standard atmospheres for preconditioning, conditioning and testing shall be as specified in ISO 139.

NOTE 3 The amount of twist is not affected directly by changes in relative humidity, but since wide changes in humidity cause changes in length of some materials, all determinations should be made on samples in equilibrium with the appropriate standard atmosphere.

Generally it is not necessary to precondition samples before conditioning for twist tests.

7 Sampling

Samples shall be taken in one of the following ways:

a) according to directions, if any, given in the material specification;

b) according to procedures approved by ISO for textile products, if directions on sampling are not included in the material specification;

c) according to the method given in annex A, if neither a) nor b) is applicable.

1) Bulk samples shall be taken as directed in A.1 of annex A.

2) Laboratory sample packages shall be taken from the bulk sample as directed in A.2 of annex A.

8 Test specimens

8.1 Length

8.1.1 Single spun yarns

The initial length of the specimen shall be as great as possible, but shall be somewhat less than the average length of the staple fibre used to spin the yarn. The initial lengths of specimens listed in table 1 are commonly used.

Table 1 — Specimen lengths

Type of yarn material	Specimen initial length mm
Cotton	10 and 25
Worsted	25 and 50
Woollen	25 and 50
Bast fibre	100 and 250

8.1.2 Single multifilament yarns

Take an initial length of 250 mm ± 0,5 mm if the nominal twist is ⩾ 1 250 turns/m.

Take an initial length of 500 mm ± 0,5 mm if the nominal twist is < 1 250 turns/m.

8.1.3 Folded and cabled yarns

Take an initial length of 250 mm ± 0,5 mm if the nominal twist is ⩾ 1 250 turns/m.

Take an initial length of 500 mm ± 0,5 mm if the nominal twist is < 1 250 turns/m.

8.2 Selection

8.2.1 Test specimens shall be taken, at the lowest tension practicable, from the end of the package if this is the normal method of use; otherwise, take the yarn from the side of the package. Discard the few metres of yarn at the beginning and end of the package in order to avoid damaged sections.

If it is desired to reel laboratory sample skeins, the yarn specimens shall be taken as specified in 8.2.1 and shall be representative of the original package.

8.2.2 If two or more test specimens are taken from an individual yarn package, they shall be taken at random intervals of at least 1 m in order to minimize the effects of cyclic variation introduced during manufacture. If more than two specimens are taken from an individual package, take groups of specimens, not more than five to a group, at intervals of several metres.

8.3 Number of test specimens

8.3.1 Take the number of specimens required in the material specification, when applicable.

8.3.2 In the absence of material specification, take a number of specimens designed to give the precision specified below, following the directions given in 8.3.3 or 8.3.4, depending on the information available on the variation of twist results in the material being tested.

8.3.3 If information on variation is available, take a number of specimens, n, calculated by the formula given in table 2, to secure the precision specified at a probability of 95 %.

Table 2 — Formula for number of specimens, n, using information on variation

Type of yarn	Range of twist	Precision	Formula for n [1]
Single multifilament	Less than 40 turns/m	± 4,0 turns/m	$0{,}240\sigma^2$
Single multifilament	40 turns/m to 100 turns/m	± 5,0 turns/m	$0{,}154\sigma^2$
All other yarns	—	± 5 %	$0{,}154v^2$

1) Where σ is the standard deviation of individual results, determined from extensive past records on similar material; v is the coefficient of variation of individual test results, determined from extensive past records on similar materials.

8.3.4 If no information on variation is available or in the case of a dispute, determine the number of specimens as follows.

a) Take the number of specimens, n, specified in table 3, which also indicates the variation assumed to calculate n;

b) calculate the coefficient of variation, v, or the twist results by normal statistical methods. If the variation is such that the precision with 95 % confidence is greater than 5 %, increase the number of tests. The number of tests required can be calculated as follows:

$$n = \left(\frac{1{,}96v}{5}\right)^2$$

where

n is the number of tests;

v is the coefficient of variation of individual test results, determined from extensive past records on similar materials.

9 Procedure 1 — Determination of direction of twist

Hold one end of the yarn in such a position that a short length (at least 100 mm) is suspended in a vertical position. Examine the vertical section of the yarn and determine if the slope of the yarn elements (fibres, filaments or component yarns) conforms to the slope of the central portion of the letters "S" or "Z". Designate the direction of twist as "S" or "Z" as observed, in accordance with ISO 2.

10 Procedure 2 — Determination of amount of twist

10.1 Preliminary procedure

Bring the laboratory sample packages, or the laboratory sample skeins reeled (5.4) from the packages, to equilibrium in the standard atmosphere for testing as specified in ISO 139.

Table 3 — Number of specimens, n, in the absence of information on variation

Type of yarn	Range of twist	n	Assumed variation[1]
Single, spun	All	50	v = 18 %
Single, multifilament	Less than 40 turns/m	20	σ = 8,0 turns/m
Single, multifilament	40 turns/m to 100 turns/m	20	σ = 10,0 turns/m
Single, multifilament	More than 100 turns/m	20	v = 10 %
Folded yarns and cabled yarns	All	20	v = 10 %

1) Where v and σ are as defined in table 2, footnote 1)

Unwind the yarn over the end or from the side of the package, as in normal use of the package and at the lowest practicable tension, taking care, when unwinding and handling the samples, to avoid any change in the original twist. Unwind and discard approximately 5 m of yarn before taking the first specimen.

Mount the specimen in the clamps of the twist counter (5.1) before cutting it free from the package. If additional specimens are to be taken from the package, hold the free end in a stationary clip or clamp, or under a weight, to prevent loss of twist.

10.2 Single, spun yarn

10.2.1 Set the movable clamp of the twist counter (5.1) at the distance specified for the nominal staple length of the fibres in the spun yarn being tested, ± 0,5 mm (see 8.1.1). Remove any lateral play in the clamps which might significantly affect the gauge length of the specimen. Verify the gauge length by measuring the clamp separation with an accurate gauge or caliper. Set the revolution counter to zero.

10.2.2 Taking care not to disturb the twist, mount the specimen in the clamps under a pretension equivalent to (0,5 ± 0,1) cN/tex.

If yarns which extend 0,5 % or more under the specified pretension are to be tested they shall be subjected to a pretension which produces an extension not greater than 0,1 %. The pretension used in these exceptional cases shall be reported and shall be agreed to by all persons interested in the test results.

10.2.3 Remove the twist by turning the rotatable clamp until it is possible to pass a needle (5.2) from the face of the nonrotatable clamp to the face of the rotatable clamp between the untwisted fibres. Use a means of magnification (5.3), if necessary, to make sure that all the twist has been removed.

10.2.4 Note the direction of twist as indicated on the revolution counter. Be sure it agrees with the direction determined by inspection of the specimen (clause 9).

10.2.5 Record the initial length, the direction of twist and the number of turns (to the accuracy specified in 5.1) in the specimen.

10.2.6 Repeat the operation until the required number n of specimens has been tested (see 8.3).

10.3 Single, multifilament yarns

10.3.1 Set the clamps of the twist counter (5.1) at a distance of 250 mm (or, by agreement, 500 mm) ± 0,5 mm. Remove any lateral play in the clamps that might significantly affect the gauge length of the specimen. Verify the gauge length of the specimen by measuring the clamp separation with an accurate gauge or caliper. Set the revolution counter to zero.

10.3.2 Proceed as directed for single, spun yarns in 10.2.2 to 10.2.5.

10.3.3 When information on change in length on untwisting is desired, release the mechanism fixing the movable clamp and determine the length of the original specimen after untwisting and under the original tension. Note the change in length and specify increase or decrease in length.

10.3.4 Repeat the operation until the required number n of specimens has been tested (see 8.3).

10.4 Folded yarns

10.4.1 Determine the folding twist by the procedures given for single, multifilament yarns in 10.3.1 to 10.3.3.

10.4.2 After removing the folding twist, cut loose and remove all but one (see note below) of the component yarns to obtain an individual end of the single yarn. It is assumed that all components of the original yarn have the same direction and amount of twist. If this is not known to be so, it shall be verified. If any difference in kind exists, each component yarn shall be tested and reported separately.

NOTE 4 If the component yarns are spun yarns, additional specimens will be required, and it is desirable to save the cut-away strands without loss of twist to provide the specimens.

10.4.3 If the single yarn component has been spun from staple fibres, determine the twist in the single yarn in accordance with 10.2, but if the single yarn component is multifilament, determine the twist in accordance with 10.3.

10.4.4 When information on change in length on untwisting is desired, released the mechanism fixing the movable clamp and determine the length of the original components after untwisting and under the original tension. Note the change in length and specify increase or decrease in length.

10.4.5 Repeat the operation until the required number n of specimens has been tested (see 8.3).

10.5 Cabled yarns

10.5.1 Determine the cable twist as directed for single multifilament yarns in 10.3.1 to 10.3.3, to obtain the total number of turns of hawser or cable twist in the test specimens.

10.5.2 After removing the cable twist, cut loose and discard all but one of the component yarns to obtain an individual strand of folded yarn. Note the length under the original tension and determine the folding twist as directed for multifilament yarns in 10.3.1 to 10.3.3 to obtain the total number of turns of the folded yarn component (see 10.4.2).

10.5.3 Cut loose and remove all but one of the component yarns to obtain an individual single yarn (see 10.4.2).

10.5.4 If the single yarn has been spun from staple fibres, determine the single yarn twist in accordance with 10.2, but if the single yarn is multifilament, determine the single yarn twist in accordance with 10.3.

10.5.5 When information on change in length on untwisting is desired, release the mechanism fixing the movable clamp and determine the length of the original components after untwisting and under the original tension. Note the change in length and specify increase or decrease in length.

10.5.6 Repeat the procedure until the required number n of specimens has been tested (see 8.3).

10.5.7 If it is desired to determine the final twist in the single and folded yarn components, all strands shall be cut free from the original specimen except for the component to be tested. The strands remaining in the clamps may be tested as directed for spun or single filament yarns in 10.2 or 10.3.

11 Calculation of results

11.1 Average twist per specimen

Calculate the average twist per test specimen, in turns per metre, using the formula

$$t_x = \frac{1\,000x}{l}$$

where

t_x is average twist, in turns per meter;

l is the length of the test specimen before untwisting;

x is the total number of turns observed in the test specimen.

11.2 Average twist per sample

Calculate the average twist per sample, in turns per metre, using the formula

$$\bar{t}_x = \frac{\Sigma t_x}{n}$$

where

$\bar{t}_x$ is average twist per sample;

Σt_x is the sum of the average twist in all test specimens;

n is the number of test specimens.

11.3 Variation of observations

If the coefficient of variation and 95 % confidence interval of the twist are desired, they shall be calculated by standard statistical methods.

11.4 Change in length on untwisting

If the change in initial length is desired, it shall be calculated according to the following formula, and reported as extension or contraction, as appropriate.

$$\Delta l = \frac{l_u - l_t}{l_t} \times 100$$

where

$|\Delta l|$ is percentage extension if Δl is a positive value;

$|\Delta l|$ is percentage contraction if Δl is a negative value;

l_t is the length of the twisted specimen;

l_u is the length of the untwisted specimen.

Values calculated for yarns spun from short fibres are considered too unreliable to be reported.

11.5 Twist factor (α)

If desired, the twist factor can be calculated, as follows:

$$\alpha = t\left(\frac{\rho_l}{1\,000}\right)^{1/2}$$

where

α is the twist factor;

t is the twist, in turns per metre;

ρ_l is the linear density, expressed in tex.

NOTE 5 Twist factor can also be calculated from the metric count:

$$\alpha = t\left(\frac{1}{\rho_l}\right)^{1/2}$$

where

α is the twist factor;

t is the twist, in turns per metre;

ρ_l is the linear density, expressed in the metric system.

12 Expression of results

Report the amount of twist in all yarns as

a) turns per metre, preferably, or

b) turns per centimetre.

Compute and report the amount of twist separately for all components of folded yarns or cabled yarns.

If desired, report the increase or decrease in length during untwisting, expressed as a percentage of the initial length for multifilament, folded or cabled yarns.

13 Test report

The test report shall state that the tests were performed in accordance with this International Standard and should indicate which of any alternative or optional requirements have been met. In addition, it shall give the following information, depending on the type of yarn.

13.1 Single yarns

a) for each package, the average twist (arithmetic mean) in the yarn, in turns per metre or turns per centimetre;

b) for all packages, the average twist (arithmetic mean) in the yarn, in turns per metre or turns per centimetre;

c) 95 % confidence interval (with appropriate dimension);

d) direction of twist, "S" or "Z", in the yarn;

e) average change in length, if required, after removal of the twist, in percent (multifilament yarns only);

f) form of the material sample (yarn package, warps, fabrics);

g) sampling scheme used;

h) number of specimens examined;

i) average length of the test specimens, in millimetres;

j) pretension used;

k) coefficient of variation of twist, if required, in each yarn, in percent;

l) twist factor, if required.

13.2 Folded yarns

a) for each package, the average folding twist, in turns per metre or turns per centimetre;

b) for all packages, the average folding twist, in turns per metre or turns per centimetre;

c) for each package, the average single yarn twist, in turns per metre or turns per centimetre (specify, if after processing);

d) for all packages, the average single yarn twist, in turns per metre or turns per centimetre (specify, if after processing);

e) direction of each twist, "S" or "Z";

f) average change in length, if required, after removal of each twist, in percent, and items 13.1 f) to 13.1 k);

g) twist factor, if required.

13.3 Cabled yarns

a) for each package, the average cable twist, in turns per metre or turns per centimetre;

b) for all packages, the average cable twist, in turns per metre or turns per centimetre;

c) for each package, the average folding twist, in turns per metre or turns per centimetre (specify, if after final processing);

d) for all packages, the average folding twist, in turns per metre or turns per centimetre (specify, if after final processing);

e) for each package, the average single yarn twist, in turns per metre or turns per centimetre (specify, if after final processing);

f) for all packages, the average single yarn twist, in turns per metre or turns per centimetre (specify, if after final processing);

g) the direction, "S" or "Z", of each twist;

h) the average change in length, if required, after removal of each twist, in percent, and items 13.1 f) to 13.1 k);

i) twist factor, if required.

Annex A
(informative)

Suggested procedure for sampling

A.1 Bulk sample (Number of cases from a shipment or lot)

Take a bulk sample of one or more cases as representative of the lot to be tested, according to table A.1.

Table A.1 — Bulk sample

Number of cases in shipment or in lot	Minimum number of cases, to be selected at random
3 or less	1
4 to 10	2
11 to 30	3
31 to 75	4
76 or more	5

Take care that none of the cases selected for sampling shows signs of damage or dampness incurred during transit.

A.2 Number of laboratory sample packages

In the absence of material specification, take ten yarn packages from the bulk sample, taking as nearly as possible the same number of packages from each case. Take packages at random from the top, middle and bottom layers in the cases and from the middles and sides of the layers. Take, as nearly as possible, the same number of specimens from each package of the laboratory sample.

If it is desired to sample woven or knitted fabrics, the samples must be large enough to furnish a sufficient number of test specimens. The test specimens shall be taken in such a manner that the twist of the yarns is not changed during sampling. When yarns in woven fabric are to be tested, warp specimens shall be taken from different ends and weft yarns shall be taken so as to represent as many cops or pirns as practicable. The specific sampling procedure shall be reported.

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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